ENCO

TURRET MILLING MACHINE

MODEL: ENCO-93600

SERVICE MANUAL

READ THIS MANUAL CAREFULLY

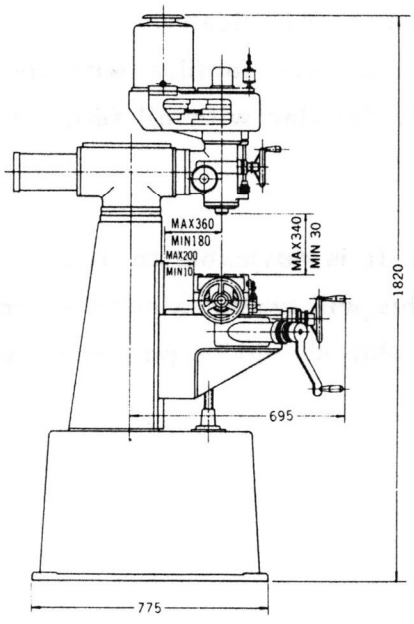
It is essential to give the Serial Number of your machine in any order of repair parts to assure prompt and accurate service.

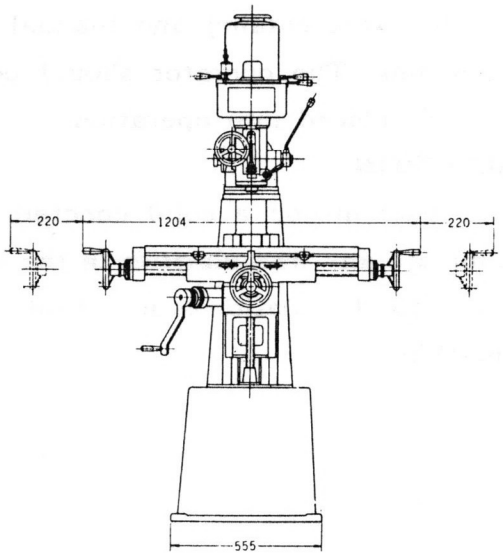
Order repair parts by part numbers, description and machine serial number.

SPECIFICATIONS

Working table surface	180×760
Longitudinal travel	440
Cross travel	190
Spindle travel	80
Distance spindle to table	340
Distance spindle to column	180
Movement of ram	180
Vertical head tilting angle (R&L)	90°
Ram swivelling angle	360°
Spindle speed (10 speeds)	60㌘ 300~ 2906 R.P.M. 50㌘ 250~ 2423 R.P.M.
Spindle nose	M.T. #3 or R-8
Speed of longitudinal feed (6 speeds)	60㌘ 17~307 mm/min 50㌘ 14~256 mm/min
Rapid longitudinal feed	60㌘ 1620 mm/min 50㌘ 1330 mm/min
Motor (vertical spindle)	3∅ 1 HP
Motor (for auto feed)	3∅ ¼HP
Net weight (approx)	550 kg
Dimensions of packing case	66" × 45" × 43" / 1 set

DIMENSION DRAWING





FEATURES

1. model **ENCO-93600** milling machine is a newly developed product, it was designed to suit the needs of technical training schools, research departments, production shops, and manufacturers of tools and dies.
2. The machine is idealy suited for conventional milling, dies, drilling and jig boring.
3. The castings are fine grained cast iron with high tensile strength and closely controlled metalurgical content. After natural ageing, the castings are annealed and furnace tempered to minimize subsequent deformation.
4. All bearing surfaces are machined on modern numerically controlled machines to ensure that uniformity and interchangeability. Then, the ways are hand scraped to provide accurate alignments and optimize lubrication effectiveness.
5. The Acme leadscrews are precision machined on a thread mill. The radial and axial critical pitch tolerances are controlled to minimize backlash.
6. The masive round ram can be infinitely adjusted to the most practical position for the work to be accomplished. The key assures consistent vertical alignment. For angular milling, the head may be swiveled and firmly secured in place by three bolts.
7. The vertical head is designed so that vibration free, quiet performance is assured. The design facilitates uniform transfer of heat. A spindle brake can be supplied as optional equipment.

PREPARATION

1. Remove the protective crating and skids carefully. In the event of damage in transient, notify the carrier promptly and inform your dealer.
2. This machine has been subjected to the **ENCO-93600** Tri-phase quality control system. Tolerance and operational tests are conducted under work simulating conditions. If any defects or irregularities are discovered, please notify your dealer.
3. Please read the catalog and manual carefully to become familar with the function of this machine. The operator should be thoroughly familar with all functions before the machine is placed into operation.

INSTALLATION

1. Set the machine on a solid concrete foundation. It is advisable to apply some "grout" to eliminate any irregularities in the concrete. This will ensure a solid foundation at all points. If the foundation is not stable, a concrete slab should be poured to accommodate the machine.

INITIAL LUBRICATION

1. Thoroughly clean the machine with a solvent which is safe to handle and which will not affect the machines painted surfaces. Lubricate always with SAE10 and gears with SAE30 lubricant. Be certain that the machine is thoroughly lubricated before starting.

LEVELING

1. Thoroughly clean the table surface. Using a precision machinist level alternately in the longitudinal and transverse positions, level the machine by use of leveling screws. If the machine is not perfectly level in both directions, it is possible that tolerances will be affected and machine movements may not be free. The machine should be periodically checked for level to ensure long life.

ELECTRICAL SOURCE

1. The control panel and illuminating lamp are located on the left side of the column. Check the motor specifications to be sure that the electrical source is proper. The spindle switch is located on the left side of the motor.

FEED STOPS

1. The longitudinal and cross feed can be set for any travel distance required by adjusting and setting the stops located on the front of the table and on the right side of knee.

ADJUSTMENT OF GIB

1. The table is provided with a full length, hand scraped, tapered gib on the front side of the saddle. There is an adjusting screw at each end. To adjust the gib, tighten the two screws until a slight drag is felt when moving the machine by hand. If the table is not tight enough, loosen the adjusting screw on the small end of the gib and tighten the other end. If the feel is too tight, reverse the procedure.

ADJUSTMENT OF SADDLE AND KNEE GIBS

1. To properly adjust the feel of the cross movement and the vertical movement, follow the same procedure as described above.

TABLE, SADDLE AND KNEE CLAMPS

1. When milling with longitudinal feed, it is advisable to clamp the knee and saddle rigidly to permit heavy cuts with a minimum of vibration. The saddle clamp is located on the left side of the machine. The knee clamp is located at the left of the knee. Leave this clamp locked at all times unless the knee is being moved.

REMOVING TABLE

1. The table may be prepared for removal by: removing handwheel, dial holder, bearing bracket and then turning the leadscrew to its extremity so that the table can be removed. This will permit easily disassembling the table from the machine.

REMOVING SADDLE

1. Remove handwheel, dial holder, bearing bracket. Then, loosen set screw on the middle of the saddle. Remove hexagon socket screws from gear box (on machines with power feed). Take off gear box, fixed pin, upper cover and withdraw saddle gib. The saddle can then be removed.

CHANGING SPINDLE SPEEDS

1. Loosen the two locking bolts on the sides of the motor. Pull back the tension lever.
2. Move the belt to the desired groove.
3. Set belt tension and lock the two locking bolts.

REMOVING MOTOR

1. proceed to loosen belt according to above instructions.
2. Take off the motor and one of the pulleys.
3. Loosen the 8 hexagon socket screws in the upper cover of the belt housing. Lock uniformly the 3 small hexagon socket screws and take off belt housing cover.
4. Loosen the 4 hexagon socket screws and take off aluminum cover.

QUILL LOCK AND QUILL FEED

1. The handle at the right lower corner of the head is the quill lock. When the vertical feed is not being used, clamp the quill lock so that maximum rigidity is assured.
2. The vertical oil cup is located in the upper side of the belt housing. Oil should be applied 2 or 3 times each day to maintain the spindle lubrication.
3. The graduated micrometer depth stop facilitates working to accurate depths. The lock nut under the micrometer nut locks the micrometer nut securely in position.
4. The feed lever on the right side of the machine provides sensitive feed for milling or drilling. To engage the fine worm feed, turn the knurled clutch nut by hand (clockwise) until the fine feed handwheel is engaged. This will permit very fine feeding for boring operations or for heavy drilling. To disengage the worm feed, turn the clutch lock nut counterclockwise.

INITIAL LUBRICATION

1. Thoroughly clean the machine with a solvent which is safe to handle and which will not affect the machines painted surfaces. Lubricate always with SAE10 and gears with SAE30 lubricant. Be certain that the machine is thoroughly lubricated before starting.

LEVELING

1. Thoroughly clean the table surface. Using a precision machinist level alternately in the longitudinal and transverse positions, level the machine by use of leveling screws. If the machine is not perfectly level in both directions, it is possible that tolerances will be affected and machine movements may not be free. The machine should be periodically checked for level to ensure long life.

ELECTRICAL SOURCE

1. The control panel and illuminating lamp are located on the left side of the column. Check the motor specifications to be sure that the electrical source is proper. The spindle switch is located on the left side of the motor.

FEED STOPS

1. The longitudinal and cross feed can be set for any travel distance required by adjusting and setting the stops located on the front of the table and on the right side of knee.

ADJUSTMENT OF GIB

1. The table is provided with a full length, hand scraped, tapered gib on the front side of the saddle. There is an adjusting screw at each end. To adjust the gib, tighten the two screws until a slight drag is felt when moving the machine by hand. If the table is not tight enough, loosen the adjusting screw on the small end of the gib and tighten the other end. If the feel is too tight, reverse the procedure.

ADJUSTMENT OF SADDLE AND KNEE GIBS

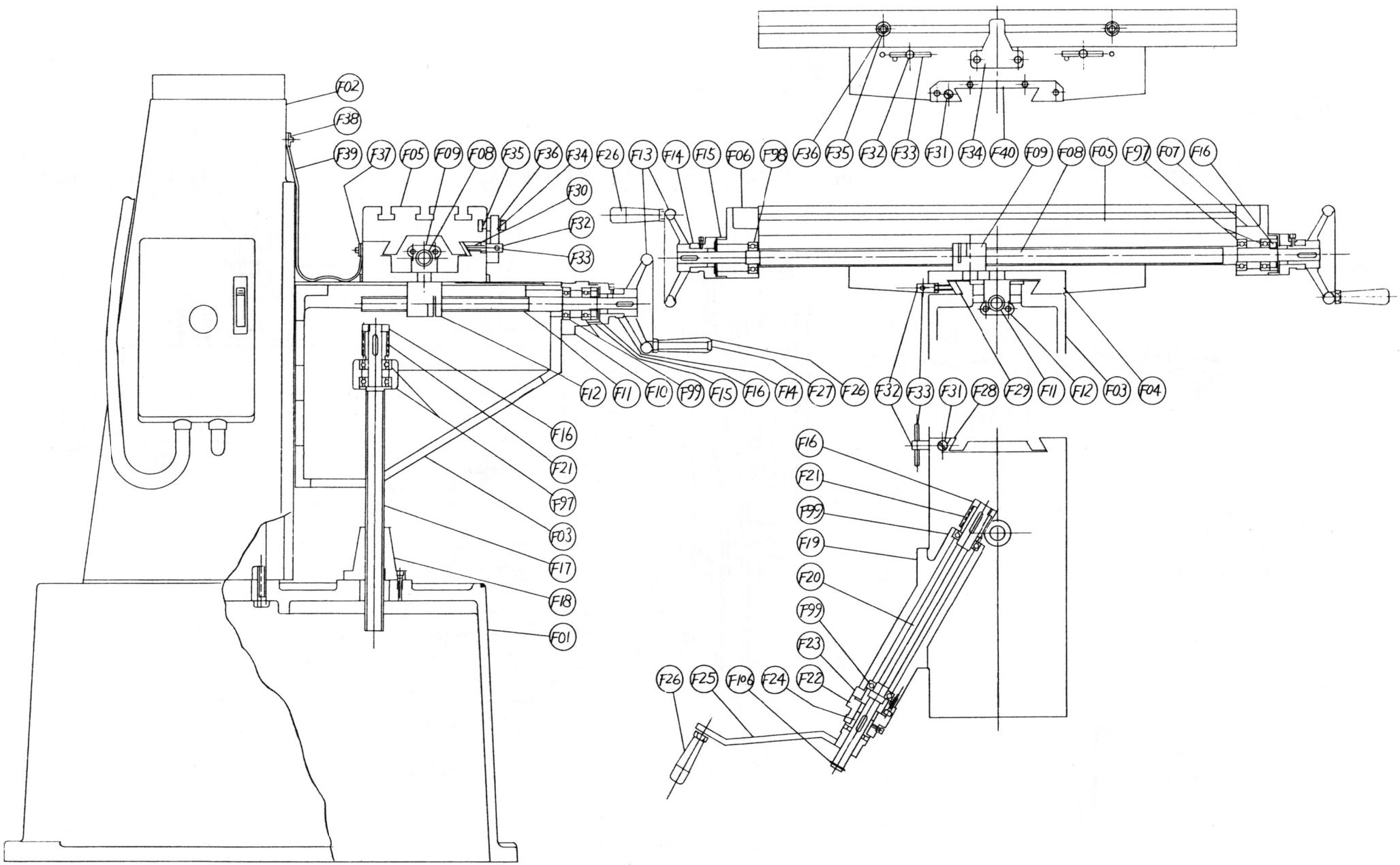
1. To properly adjust the feel of the cross movement and the vertical movement, follow the same procedure as described above.

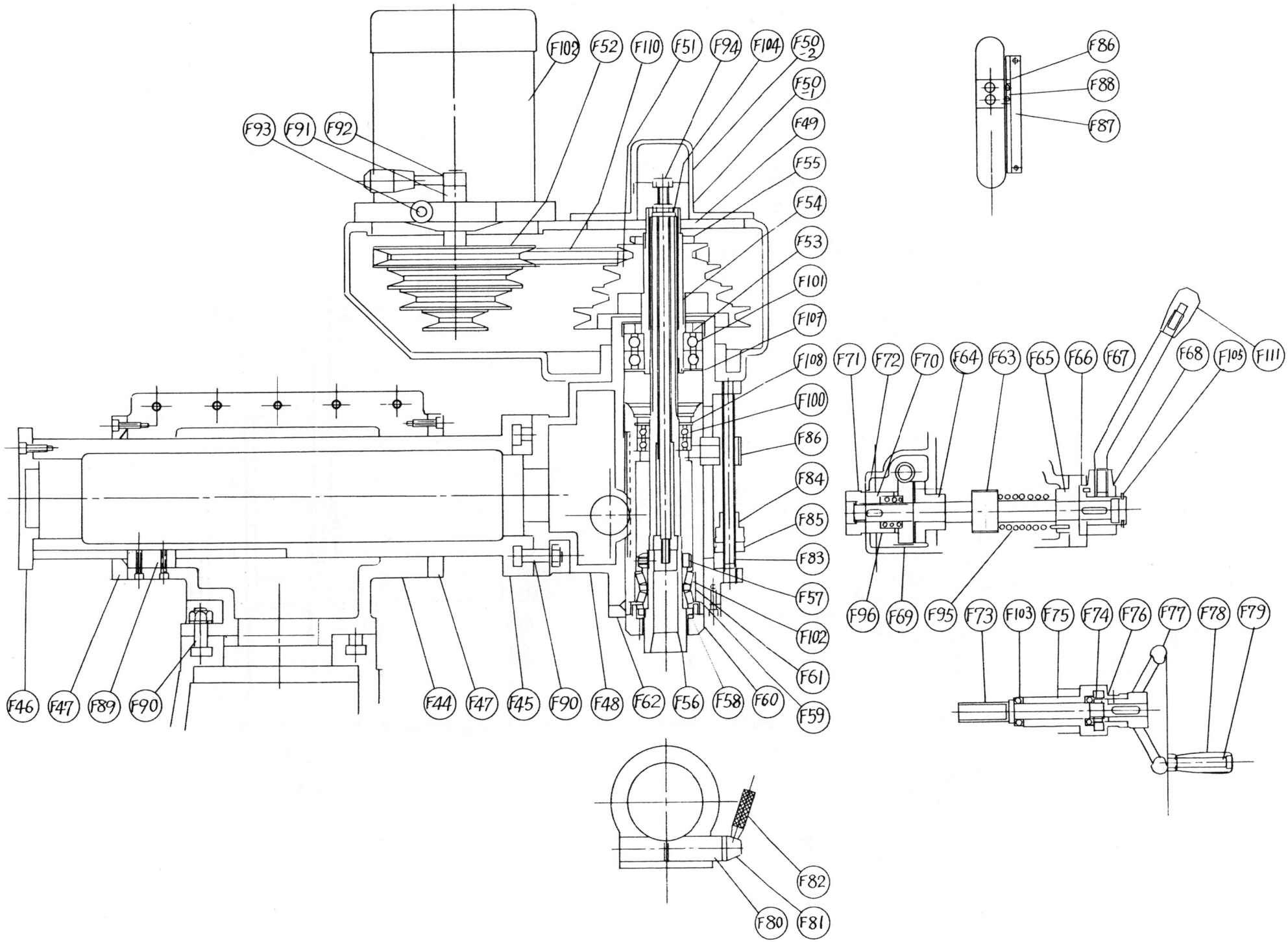
TABLE, SADDLE AND KNEE CLAMPS

1. When milling with longitudinal feed, it is advisable to clamp the knee and saddle rigidly to permit heavy cuts with a minimum of vibration. The saddle clamp is located on the left side of the machine. The knee clamp is located at the left of the knee. Leave this clamp locked at all times unless the knee is being moved.

REMOVING TABLE

1. The table may be prepared for removal by: removing handwheel, dial holder, bearing bracket and then turning the leadscrew to its extremity so that the table can be removed. This will permit easily disassembling the table from the machine.


F02
F38
F39
F37
F05
F09
F08
F35
F36
F34
F26
F13
F14
F15
F06
F98
F36
F35
F32
F33
F31
F34
F40
F09
F08
F05
F97
F07
F16
F30
F32
F33
F12
F11
F10
F99
F15
F16
F14
F27
F26
F32
F33
F31
F28
F29
F11
F12
F03
F04
F16
F21
F97
F03
F17
F18
F01
F16
F21
F99
F19
F20
F99
F23
F26
F25
F106
F24
F22


F102
F52
F110
F51
F94
F104
F50-2
F50-1
F49
F55
F54
F53
F101
F107
F108
F100
F86
F84
F85
F83
F57
F102
F61
F59
F46
F47
F89
F90
F44
F47
F45
F90
F48
F62
F56
F58
F60
F93
F91
F92
F86
F88
F87
F71
F72
F70
F64
F63
F65
F66
F67
F68
F105
F111
F96
F69
F95
F73
F103
F75
F74
F76
F77
F78
F79
F82
F80
F81

ENCO-93600 PART CHART

CHART NO:	DESCRIPTION	MATERIAL	SPECIFICATION	PIECE	
F 01	Base	FC - 20			
F 02	Column	〃		1	
F 03	Knee	〃		1	
F 04	Cross slide	〃		1	
F 05	Slide	FC 25		1	
F 06	Bracket	FC 20		1	
F 07	Longitudinal bearing bracket	〃		1	
F 08	Longituinal lead screw	S 45 C - D	1″D × 943 ℓ	1	
F 09	Gear setting cap			1	
F 10	Bracket	FC 20		1	
F 11	Cross lead screw	S 45 C - D	⅞″ × 413 ℓ	1	
F 12	Cross feed nut			1	
F 13	Hand wheel	FC 20		3	
F 14	Dial	S 20 C	2 ½″ D × 40 ℓ	3	
F 15	Dial supporting ring	〃	65 φ −50 φ × 18 ℓ	3	
F 16	Locking nut	〃	38 φ × 13 ℓ	4	
F 17	Elevating lead screw	S 45 C	1⅛″ D × 448 ℓ	1	
F 18	Elevating lead screw set nut	FC 20		1	
F 19	Gear shaft sleeve	〃		1	
F 20	gear shaft	S 45 C	25 φ × 435 ℓ	1	
F 21	Elevating Gear	〃	40 × 46 ℓ	2	
F 22	Dial	S 20 C	70 φ × 41 ℓ	1	
F 23	Elevating sub dial	〃	70 φ × 21 ℓ	1	
F 24	Elevating Handle clutch	S 45 C	42 φ × 35 ℓ	1	
F 25	Handle arm	FC 20		1	
F 26	Handle bar sleeve	S 20 C - D	22 φ × 73 ℓ	4	
F 27	Handle bar bolt	〃	12 φ × 97 ℓ	4	
F 28	Knee gib	FC 20		1	
F 29	Copper block	〃		1	
F 30	Copper block	〃		1	

ENCO-93600 PART CHART

CHART NO:	DESCRIPTION	MATERIAL	SPECIFICATION	PIECE	
F 31	Gib adjusting screw	S20C-D	14 ϕ × 44 ℓ	6	
F 32	Table locking nut	〃	½" D × 53 ℓ	4	
F 33	Handle bar	〃	¼" D × 62 ℓ	4	
F 34	Stopper	FC 20		1	
F 35	Longitudial stop screw	S20C	20 ϕ × 42 ℓ	2	
F 36	Longitudinal sto block nut	〃	19 ϕ × 21 ℓ	2	
F 37	Washer	SS41	3 t × 19 w × 206 ℓ	1	
F 38	Washer	〃	3 t × 19 w × 116 ℓ	1	
F 39	Plastic sheet	P.V.C.		1	
F 40	Chip guard	〃		2	
F 41	Switch box			1	
F 42	Buttom plate			1	
F 43	Control box	SS41		1	
F 44	Vertical head adapter	FC 20		1	
F 45	Flexible tube	〃		1	
F 46	Tail cover	〃		1	
F 47	Felt ring	〃		2	
F 48	Vertical head	〃		1	
F 49	Belt housing			1	
F 50	Draw bar cover	〃		1	
F 51	Spindle pully	FC 20		1	
F 52	Motor pully	〃		1	
F 53	Bearing locking nut	〃		1	
F 54	Key	S45C	45 ϕ × 168 ℓ	1	
F 55	Pully locking nut	S20C	68 ϕ × 11 ℓ	1	
F 56	Vertical spindle	S45C	45 ϕ × 438 ℓ	1	
F 57	Bearing adjusting nut	〃	55 ϕ × 17 ℓ	1	
F 58	Spindle oilseat	S20C	55 ϕ × 12 ℓ	1	
F 59	Quill	S45C	85 ϕ × 214 ℓ	1	
F 60	Locking nut	S20C	85 ϕ × 33 ℓ	1	

ENCO-93600 PART CHART

CHART NO:	DESCRIPTION	MATERIAL	SPECIFICATION	PIECE	
F 61	Collar	S20C	65 ϕ × 8 ℓ	1	
F 62	Felt ring	FC 20		1	
F 63	Quill pinion shaft	S45C	45 ϕ × 262 ℓ	1	
F 64	Pinion shaft seat	FC 20		1	
F 65	Pinion shaft seat	〃		1	
F 66	Pinion shaft sleeve	S45C	50 ϕ × 50 ℓ	1	
F 67	Handle bar	S20C	½″ × 202 ℓ	1	
F 68	Handle bar seat	FC 20		1	
F 69	Pinion shaft seat	S45C	65 ϕ × 23 ℓ	1	
F 70	Clutch	〃	42 ϕ × 33 ℓ	1	
F 71	Clutch adjusting nut	〃	45 ϕ × 23 ℓ	1	
F 72	Clutch cover	FC 20		1	
F 73	Fine feed worm shaft	S45C	25 ϕ × 192 ℓ	1	
F 74	Washer for bearing	S20C	25 ϕ × 7 ℓ	2	
F 75	Worm shaft sleeve	FC 20		1	
F 76	Dial	S20C	55 ϕ × 37 ℓ	1	
F 77	Handle wheel	FC 20		1	
F 78	Handle bar sleeve	S20C-D	19 ϕ × 57 ℓ	1	
F 79	Handle bar	〃	12 ϕ × 74 ℓ	1	
F 80	Quill lock Block	FC 20		1	
F 81	Quill locking bolt	S20C	1″ × 103 ℓ	1	
F 82	Hand bar	〃	11 ϕ × 58 ℓ	1	
F 83	Quill stop micro screw	〃	⅝″D × 203 ℓ	1	
F 84	Micro meter nut	〃	35 ϕ × 33 ℓ	1	
F 85	Quill micro stop nut	〃	35 ϕ × 13 ℓ	1	
F 86	Quill stopper	SS41	30 × 30 × 45 ℓ	1	
F 87	micro meter scale	〃	6 t × 16 w × 117 ℓ	1	
F 88	micro meter pointer	〃	8 t × 16 w × 22 ℓ	1	
F 89	Key	〃	20□ × 50 ℓ	1	
F 90	Adapter bolt set	S20C	1″D × 54 ℓ	6	

ENCO-93600 PART CHART

CHART NO:	DESCRIPTION	MATERIAL	SPECIFICATION	PIECE	
F 91	Screw for motor	S 20 C	22 ϕ × 73 ℓ	2	
F 92	Screw bar	〃	22 ϕ × 16 ℓ $\frac{3}{8}$″D × 62 ℓ	2	
F 93	bar for motor	〃	$\frac{1}{2}$″ × 97 ℓ	1	
F 94	Draw bar	S 45 C	$\frac{1}{2}$″ × 392 ℓ	1	
F 95	Spring	S_{UP}		1	
F 96	Spring	S_{UP}		1	
F 97	Ball bearing		6204 Z	6	
F 98	〃		6303 Z	1	
F 99	〃		6004 Z	2	
F100	〃		6006	2	
F101	〃		6208	2	
F102	Taper roller bearing		32007	2	
F103	Taper roller bearing		51102	2	
F104	Bearing		6007	1	
F105	Rings		E - 40	1	
F106	〃		E - 25	1	
F107	〃		C - 62	1	
F108	〃		〃 C - 80	1	
F109	Motor			1	
F110	Belt			1	
F111	Hand bar sleeve (Plastic)		$\frac{3}{8}$″ NC	4	